THE INFLUENCE OF GROWTH PROMOTANT ANTIBIOTICS AND MANAGEMENT SYSTEM ON THE PRESENCE AND PREVALENCE OF SALMONELLA IN SWINE

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Food contamination due to Salmonella is the cause of large numbers of human food-borne illnesses worldwide. Reduction in fecal shedding and prevention of new Salmonella infections in livestock during the late finishing/marketing phase of production are critical control points associated with human food safety. The objectives of this research were to compare the effects of various treatments on the shedding of Salmonella during the late finishing phase of production in littermate swine reared under different management conditions. The treatments compared were: 1) multi-site segregated early weaning (SEW) versus continuous flow (CF) rearing of swine, 2) growth promotant antibiotics (medicated) versus no feed antibiotics (unmedicated), 3) 24 hour fasting versus full-feeding.

METHODS

The 288 pigs included in this study were from two different genetic sources. Littermate pigs were divided among 4 treatment groups; CF medicated, CF nonmedicated, SEW medicated, SEW nonmedicated. Pigs were housed in pens of 6-7 animals, all penmates being from a single genetic source and treatment group. The SEW pigs (144) were placed in clean, off-site nursery facilities at approximately 13 days of age and moved at 8 weeks of age to a cleaned, disinfected curtain-sided grower-finisher building at a third site, where they were reared until market weight of 240-260 lb. Littermate pigs (144) were weaned at approximately 26 days of age into an on-site all-in, all-out nursery. At 8 weeks of age, they were moved into a continuous flow finisher, interspersed with pens of varying age pigs, where they remained until reaching market weight. Pigs in the medicated treatment groups received feed supplemented with Carbadox (50 g/ton) in nursery rations and Bacitracin Methylene Disalicylate (BMD, 30 g/ton) in grower/finisher rations. Pigs with clinical signs of illness in any treatment group were treated with other short-term antibiotics as recommended by attending veterinarians.

Rectal fecal specimens (approximately 1 g/pig) were collected from all study pigs at approximately 4 1/2 months of age and at 3-4 week intervals thereafter until slaughter. Fecal specimens were suspended in 4 ml buffered peptone broth (BBL, Cockeysville, MD) and transported to the laboratory within 4 hours. One milliliter of each sample was transferred to 9 ml tetrathionate enrichment broth (VWR Scientific Products, Willard, OH) and the tubes incubated for 48 hr at 37°C. Approximately 1 μl of each enriched sample was then streaked on XLT4 agar (Miller, et al., 1991) and incubated 18-24 hr at 37°C. Colonies with black centers were identified as Salmonella suspect and confirmed with triple sugar iron (TSI) agar and lysine iron agar (LIA) (Difco). Salmonella suspect cultures were also tested by PCR using Salmonella sp. specific primers (Stone, et al. 1994) and were submitted to the National Veterinary Service Laboratory (Ames, IA) for serotyping.

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All animals that tested positive for *Salmonella*, as well as their penmates, were re-tested at weekly intervals. When any pigs in a *Salmonella* positive pen reached market weight, all penmates were fasted for 24 hours on the day prior to shipping. Rectal fecal specimens were collected before and after the 24 hour fast. Subsequent to the fast, pigs being marketed were allowed feed *ad libitum* for approximately 4 hours, then sorted, mixed, shipped to the slaughterhouse (approximately 1 hour transit time) and held without food for an additional 12-18 hours prior to slaughter. When possible, cecal contents, cecal wall and ileocecal lymph nodes were collected and cultured from *Salmonella* positive pigs and negative penmates at slaughter.

RESULTS

Of the 288 pigs included in this study, a total of 9 pigs (3%) tested positive on one or more occasions for *Salmonella* spp. Two serotypes of *Salmonella* were identified from pigs in this study. *Salmonella anatum* was isolated only from pigs of genetic source A, while *Salmonella derby* was isolated from all positive pigs of genetic source B, as well as one pig (divergent serotype) of genetic source A. The pig from which the divergent serotype was isolated was the only pig that tested positive for *Salmonella* in the continuous flow facilities, and this pig only tested positive in cecal contents at slaughter. The remaining eight positive pigs were all reared in the SEW facilities. Seven of the 9 *Salmonella* positive pigs were in the medicated treatment groups.

No pigs subjected to an 18-24 hour fast converted from a fecal negative to a fecal positive state at the end of a 24 hour fast. A number of pigs underwent multiple 18-24 hour fasts on successive weeks without being mixed and transported (three pigs fasted 2 successive weeks; 2 pigs fasted 3 successive weeks and 2 pigs fasted 4 successive weeks); none of these pigs had detectable levels of *Salmonella* spp. in feces at 3-7 days post-fasting. Three pigs had *Salmonella* isolated from cecal contents only at slaughter. One was the pig from the continuous flow facility from which the divergent serotype was isolated; the remaining 2 pigs were penmates of pigs identified as *Salmonella* positive prior to slaughter.

Of the three pigs positive only at slaughter, two had *Salmonella* isolated only from the cecal contents, suggesting that infection may have been of recent origin. The third pig from the SEW facility was culture positive for *Salmonella* in the cecal contents, the cecal wall and ileocecal lymph node, suggesting a chronic infection with *Salmonella*. This pig had two penmates that also cultured *Salmonella* positive; one penmate was positive once 3 weeks prior to slaughter, and the second penmate was fecal culture positive 3 weeks prior to slaughter and at slaughter in cecal contents. Carcasses of 2 additional animals that tested positive prior to slaughter were unavailable for postmortem testing.

CONCLUSIONS

The results of this study support an earlier observation by our group that *Salmonella* spp. are more prevalent in pigs reared in SEW management systems as compared to continuous flow facilities (Nielsen and Patterson, 1996). *Salmonella* was also more prevalent in pigs receiving growth promotant antibiotics in the ration, although the number of positive pigs in each group were too small to be statistically significant. Fasting alone did not effect the prevalence or shedding of *Salmonella* in the pigs in this study.
The combination of fasting followed by mixing with other pigs, shipping and holding in a strange environment prior to slaughter may have resulted in either recrudescence and shedding in *Salmonella* positive carrier pigs, or initiation of *Salmonella* infection in the three animals found positive only at slaughter. A fourth pig was positive at an earlier ante mortem sampling as well as at slaughter, indicating either continued cycling and re-infection within a pen of pigs, or a prolonged carrier state with intermittent shedding. Three animals that tested positive at earlier ante mortem sampling periods were negative for *Salmonella* at slaughter.

Only one pig out of 16 tested had *Salmonella* isolated from tissues (cecal wall and ileocecral lymph node). The presence of *Salmonella* in these tissues would support the hypothesis that this pig was a carrier pig with intermittent fecal shedding. This pig, however was never positive in antemortem fecal culture, although 2 penmates had antemortem fecal positive cultures and one also had a postmortem *Salmonella* isolation from cecal contents. These results support the hypothesis that the combined stress of fasting, transport to unfamiliar surroundings, and commingling with a few carrier pigs may cause shedding and spread of *Salmonella* among pigs.

Further studies utilizing serologic tests of pigs for antibodies to *Salmonella* combined with fecal culture would help determine whether pigs positive only in cecal contents at slaughter were indeed non-shedding carriers prior to stressing, or were naive pigs that became infected during commingling and holding prior to slaughter. Further studies on *Salmonella* incidence rates in swine reared under high health management systems, as well as study of interdiction methods to decrease *Salmonella* incidence are warranted.

REFERENCES

